REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the pending application. The Office Action dated June 15, 2004 has been received and its contents carefully reviewed.

Applicants thank the Examiner for allowing claims 1-8, 10-15, and 19-21 and for indicating that claims 22-24 contain allowable subject matter.

In the Office Action, the Examiner objects to claim 9 for lacking antecedent basis for a term. Claims 9 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,636,192 to Saitoh.

Applicants amend claim 9 to correct a minor typographical error. Accordingly, Applicants respectfully request the Examiner to withdraw the objection to and rejection of claim 9.

Applicants note that the effective filing date of Saitoh, the filing date of the PCT application, is January 25, 2000 which is after the foreign priority date of September 1, 1999 of the present application. Applicants perfect their claim to priority under 35 U.S.C. 119 by filing a certified English language translation of the priority document Korean Patent Application No. 1999-36786. Thus Saitoh is not a proper prior art reference under 35 U.S.C. 103(a), and Applicants respectfully request the Examiner to withdraw Saito as a prior art reference.

Applicants believe the foregoing arguments and removal of Saitoh as a prior art reference places the application in condition for allowance and early, favorable action is respectfully solicited.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at (202) 496-7500 to

discuss the steps necessary for placing the application in condition for allowance. All correspondence should continue to be sent to the below-listed address.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed

Dated: September 15, 2004

Respectfully submitted,

By _____
George G. Ballas
Registration No.: 52,587
MCKENNA LONG & ALDRIDGE LLP
1900 K Street, N.W.
Washington, DC 20006
(202) 496-7500
Attorney for Applicant

VERIFICATION OF TRANSLATION

I, Hyun-Duk Keum of 901 Seoyoung Bldg., 158-12, Samsung-dong, Kangnam-ku, Seoul, 135-090, Korea, declare that I have a thorough knowledge of the Korean and English languages, and the writings contained in the following pages are correct English translation of the specification and claims of Korean Patent Application No. 1999-36786.

This 15th day of September, 2004

By:

[Hyun-Duk Keum]

KOREAN INDUSTRIAL

PROPERTY OFFICE

This is to certify that the following application annexed hereto

is a true copy from the records of the Korean Industrial Property Office

Application Number : **1999 year Patent Application 36786, 10-1999-0036786**

Date of Application : **September 1, 1999**

Applicant(s) : **LG. Philips LCD Co., Ltd.**

COMMISSIONER

[BIBLIOGRPHICAL DOCUMENTS]

[TITLE OF DOCUMENT] PATENT APPLICATION

[CLASSIFICATION] PATENT

[RECIPIENT] COMMISSIONER

[SUBMISSION DATE] 01. 09. 1999

[TITLE OF INVENTION IN KOREAN] 액정 표시장치의 씰 패턴 형성방법

[TITLE OF INVENTION IN ENGLISH] Method of forming a seal pattern for liquid crystal display device

[APPLICANT]

[NAME IN KOREAN] 엘지. 필립스 엘시디 ㈜

[NAME IN ENGLISH] LG. Philips LCD Co., Ltd.

[APPLICANT CORD] 1-1998-101865-5

[ATTORNEY]

[NAME] Jung, Won-Ki

[ATTORNEY CORD] 9-1998-000534-2

[ALL-INCLUSIVE AUTHORIZATION REGISTRATION NO.] 1999-001832-7

[INVENTOR]

[NAME IN KOREAN] 이상석

[NAME IN ENGLISH] LEE, Sang Seok

[IDENTIFICATION NO.] 710616-1101919

[ZIP CODE] 617-020

[ADDRESS] 203-ho, 104-dong, Keumgang Apt., Hakjang-dong, Sasang-gu, Busan, 617-020, Republic of Korea

[NATIONALITY] KR

[INVENTOR]

[NAME IN KOREAN] 우정원

[NAME IN ENGLISH] WOO, Joung Won

[IDENTIFICATION NO.] 700606-1009929

[ZIP CODE] 131-141

[ADDRESS] 109-1, Mook 1-dong, Joongrang-gu, Seoul, 131-141, Republic of Korea

[NATIONALITY] KR

[PURPORT] We submit application as above under the article 42 of the Patent Law.

Attorney Jung, Won-Ki (seal)

[FEES]

[BASIC APPLICATION FEE]	20 pages	29,000	Won
[ADDITIONAL APPLICATION FEE]	1 pages	1,000	Won
[PRIORITY FEE]	0 things	0	won
[EXAMINATION REQUEST FEE]	0 clamis		Won
[TOTAL]		30,000	Won

[ENCLOSED] 1. Abstract, Specifications (with Drawings)_1 set

[DOCUMENT OF ABSTRACT]

[ABSTRACT]

The present invention relates to a seal pattern which prevents a liquid crystal from leaking outside in a liquid crystal display device.

The present invention relates to a seal pattern formation in the liquid crystal display device that can improve spots on the display by forming the seal pattern into triangular or circular shape using a dispense-printing method in case of forming the seal pattern.

[REPRESENTATIVE FIGURE]

FIG. 5

[SPECIFICATIONS]

[NAME OF THE INVENTION]

Method of forming a seal pattern for liquid crystal display device

[BRIEF EXPLANATION OF FIGURES]

Fig. 1 is a block diagram illustrating a general manufacturing process of a liquid crystal cell.

Fig. 2 is a perspective view illustrating a seal pattern process with a screen-print method used generally.

Fig. 3 is a plan view illustrating the seal pattern around a silver dot.

Fig. 4 is a perspective view illustrating a dispenser-print method for the seal pattern.

Fig. 5 is a plan view illustrating the seal pattern around the silver dot according to an embodiment of the present invention.

Fig. 6 is an expanded plan view of "r_1" of Fig. 5.

Fig. 7 is a plan view illustrating the seal pattern around the silver dot according to another embodiment of the present invention.

* Explanation of major parts in the figures *

10: conductive contact dot 200: seal pattern

[DETAILED DESCRIPTION OF INVENTION]

[OBJECT OF THE INVENTION]

[TECHNICAL FIELD OF THE INVENTION AND PRIOR ART OF THE FIELD]

The present invention relates to a manufacturing process of a liquid crystal display device, and more particularly to, a method of forming a seal pattern in a manufacturing method of a liquid crystal display panel.

A general liquid crystal display device comprises a lower substrate, a substrate aligns a thin film transistor, and an upper substrate prints a color filter, and a liquid crystal is located between the upper and lower substrates.

The brief manufacturing process of the liquid crystal in the liquid crystal display device and its operation are as follows:

After a common electrode is formed in one face of each inside opposing the two substrates, the upper plate and the lower plate and a pixel electrode is formed in anther face, and the substrates are aligned spaced apart from each other so that the electrodes are opposite to each other, a liquid crystal is injected into the gap between the upper and lower substrates and then a injection hole is sealed. And then, the liquid cell is completed by attaching a polarized plate into each outside of the upper and lower substrates.

Also, the amount of light passing through the liquid crystal cell is controlled by electrical filed applied into both electrodes (pixel electrode and common electrode), and characters or images are displayed due to the light shutter effect.

Compared with the thin film transistor or color filter manufacturing processes, it is characteristics that the liquid crystal cell manufacturing process barely has repeated steps. The total process is approximately divided into an orientation film forming process for orienting the liquid crystal molecules, a cell gap forming process, and a cell cutting process.

Hereinafter, the manufacturing process of the liquid crystal display device above mentioned will be explained with referring to attached Drawings.

FIG. 1 is a block diagram illustrating a general manufacturing process of a liquid crystal cell. As shown in FIG. 1, the lower substrate is prepared in step "st1". Plural thin film transistors (TFTs) are aligned and plural pixel electrodes corresponding to the TFTs are formed over the lower substrate.

Step "st2" is a step to form an orientation film over the lower substrate.

Forming the orientation film comprises a depositing a polymer thin film and rubbing the polymer thin film. The polymer thin film, commonly referred to as orientation film, should be deposited with uniform depth over the total lower substrate and rubbing as such.

The rubbing process is a main process determines an initial orientation direction of the liquid crystal, and therefore, rubbing the orientation thin film enables the liquid crystal to operate normally and the device to have a uniform display property.

A typical orientation film uses mainly an organic thin film such as polyimide thin film.

The rubbing process refers to rub the orientation film in a predetermined direction with a fabric and the alignment of the liquid crystal molecules depends on the rubbing direction.

Step "st3" shows a process of printing the seal pattern.

The seal pattern in the liquid crystal cell has two functions, that is, to form a gap form injecting the liquid crystal and to prevent the liquid crystal from leaking out of the liquid crystal cell. Forming the seal pattern is a step to form a wanted pattern with a thermoplastic resin and uses mainly a screen-print method.

Step "st4" illustrates a process of scattering a spacer.

The spacer with a definite size is used in order to maintain a precise and uniform gap between the upper and lower substrates in the manufacturing processes of the liquid crystal cell. Accordingly, the spacer are scattered throughout the lower substrate with a uniform density. The scattering method is divided into a wet spray method of spraying the spacers mixed with an alcohol or a dry spray method of spraying only the spacers.

Further, the dry spray method is divided into a static electric spray method using static electricity and a non-electric spray method using a gas pressure, and since the liquid crystal cell has a feeble structure against the static electricity, the non-electric spray method is widely used in the liquid crystal cell.

After the process of scattering spacer, the upper substrate having the color filter and the lower substrate having the thin film transistor array are aligned and attached with each other ("st5").

The alignment and the attachment of the upper and lower substrates depends on the aligning margin provided in case of designing the substrates and requires an accuracy such as less than several micrometers. If the two substrates are aligned and attached beyond the aligning margin, light leaks away so that the liquid crystal cell doesn't make a desired display quality.

Step "st6" is a process cutting the liquid crystal cell fabricated through the steps "st1" to "st5" into a unit cell. Conventionally, the liquid crystal cell experiences processes such as forming plural liquid crystal cells on the large-sized glass plates and then dividing the plural liquid crystal cells into a respective liquid crystal cell, which is a cell cutting process.

In the early manufacturing process of the liquid crystal display device, the liquid crystal is injected simultaneously into several cells and then the cells cut into plural unit cells.

But, as the larger the cell size, after the cells cut into the unit cell, then the liquid crystal is injected into each unit cell.

The cutting process comprises a scribing process of forming cutting lines on the substrate with a diamond pen harder than the substrate made of glass, and a breaking process of cutting the substrate along the cutting lines by force.

Step "st7" is a step to inject the liquid crystal into the liquid crystal cell cut as each unit cell.

The unit cell has a area of a few square centimeters and a gap size of a few microns. Therefore, a vacuum injection method using the difference in pressure is widely used for injecting effectively the liquid crystal into the cell with such a structure.

Besides, FIG. 2 is a perspective view illustrating a screen-print method used in the seal pattern process "st3".

The screen-print method is facilitated with a predeterminedly patterned screen 6 and a squeegee 8 for screening.

The seal pattern 2 on the substrate 1 has two functions to form a gap for injecting the liquid crystal in the liquid crystal panel and to prevent the injected liquid crystal from leaking. In order to achieve the functions, the seal pattern 2 is formed along the edge of the substrate 1 and a liquid injection hole 4 is formed on a side of the edge.

Forming the seal pattern through the screen-print method comprises a printing process to print a thermosetting sealant comprising the spacer for maintaining the cell gap into the substrate 1 via screen 6 and a dry process for leveling to evaporate solvents contained in the sealant.

In forming the seal pattern, the uniformity in thickness and width of the sealant is a

very important management factor because the cell gap becomes irregular after hardening the seal pattern if the seal pattern 2 is not formed uniformly.

For the seal pattern 2, a thermosetting or an ultraviolet-setting epoxy resin and the like are conventionally employed. But, though the epoxy resin itself is not harmful to the liquid crystal, an amine contained in a thermosetting agent may decompose the liquid crystal. Thus, when using the epoxy resin for the seal pattern 2, the sealant formed through the screen-print method needs to be pre-baked sufficiently with a gradual change of a baking temperature.

[TECHNICAL SUBJECT OF THE INVENTION]

Conventionally, electrode pads of the liquid crystal cell are formed commonly over the lower substrate having the switching element. Accordingly, in order to apply a voltage into the liquid crystal, the common electrode should be formed over the upper substrate having the color filter and the common electric potential applied into the pads formed over the lower substrate should be contacted to the common electrode of the upper substrate using certain electric conductors.

At this point, for the electric conductors for contacting the common electric potential of the lower substrate to the common electrode of the upper substrate, a silver paste (hereinafter referred to as "silver dot") is used.

FIG. 3 is a plan view illustrating a silver dot 10 formed around the seal pattern 2.

As shown I FIG. 3, the silver dot 10 is formed on the outside of the seal pattern 2, that is to say, is formed in the opposite direction with respect to the display area "A" on the seal pattern 2.

At this point, the seal pattern 2 detours the silver dot 10 around the silver dot 10.

Since the seal pattern forming process by the screen-print method mentioned above has a superior convenience in processes, it is widely used method presently. However, the screen-print method has drawbacks such as causing inferiority owing to the contact between the screen and the orientation film over the substrate and difficulty responding to the larger substrate size.

Further, after the sealant is formed on the whole patterned screen, the squeegee rubs the sealant so as to form the seal pattern in the screen-print method. Since the sealant is formed on throughout the patterned screen, an over-waste of the sealant occurs.

In order to overcome the above-mentioned problems of the screen-print method, a dispenser-print method becomes gradually adopted.

FIG. 4 is a perspective view illustrating a seal dispenser print apparatus. As shown in FIG. 4, the apparatus comprises a dispenser 20, a table 10 and a substrate 1. The dispenser-print method uses a principle of injector, namely, in the dispenser-print method, a dispenser 20 is filled with the sealant and then the seal pattern 2 with desired width and thickness is formed by using predetermined pressures. In other words, the seal pattern 2 is formed by moving the table 100 or the dispenser 20 toward an arrow-head direction.

However, since the above-mentioned dispenser-print method has a poor print quality. For example, the seal pattern 2 shown in FIG. 3 forms a lot of bent portion "C" since the seal pattern detours the silver dot 10 around the silver dot 10. Accordingly, the conventional seal pattern with a lot of bent portion "C" cannot be operated with the above-mentioned dispenser-print method.

Besides, the seal pattern 2 protrudes into the display area "A" with a length "L" in the area of the silver dot 10 and formed as such, it may cause a display spot adjacent to the silver dot 10 in the liquid crystal display device because the amines existed in the seal pattern may

damage the liquid crystal of the seal pattern areas if the invading area by the seal pattern is larger.

The present invention is proposed in order to overcome the problems of the screen-print method and the conventional seal patterns; it is an object of the present invention to improve the display spots adjacent to the silver dot.

Another object of the present invention is to improve the print quality by enhancing the seal pattern formation in dispenser printing.

[CONSTRUCTION AND OPERATION OF THE INVENTION]

For achieving the above objects, the present invention provides a method of forming a seal pattern in a liquid crystal display device, wherein the device comprises an upper plate forming a common electrode, a lower substrate having a pad applying a common electrical potential in thereof and a liquid crystal interposed in the upper and lower substrates, wherein seal pattern prevents the liquid crystal interposed in the upper and lower substrates from leaking outside, the method comprises: forming plural conductive contact dots on the pad applying the common electrical potential of the lower substrate, the conductive contact dots applying the common electrical potential into the common electrode of the upper plate; and forming the seal pattern along edges of the lower substrate, the seal pattern having a bent shape adjacent to each of the conductive contact dot, the bent shape being bent inwardly toward the liquid crystal around the conductive contact dots and being substantially a triangular shape with a first, second and third bent portions.

Also, it is characterized that the seal pattern in the conductive contact dot is extended to the third bent portion with a predetermined radius of rotation from the first bent portion via the second bent portion, wherein the third bent portion is extended with a predetermined

radius of rotation.

Also, it is characterized that the conductive contact dot comprises a sliver (Ag).

Besides, it is characterized that the radius of the rotation of the first, second, and third bent portions is 0.5 to 2 millimeters.

In addition, it is characterized that a linear distance between the first bent portion and the third bent portion is 5 to 20 millimeters.

Further, it is characterized that a linear distance between the conductive contact dot and the second bent portion is 0.1 to 5 millimeters.

Also, the present invention provides a method of forming a seal pattern in a liquid crystal display device, wherein the device comprises an upper plate forming a common electrode, a lower substrate having a pad applying a common electrical potential in thereof and a liquid crystal interposed in the upper and lower substrates, wherein seal pattern prevents the liquid crystal interposed in the upper and lower substrates from leaking outside, the method comprises: forming plural conductive contact dots on the pad applying the common electrical potential of the lower substrate, the conductive contact dots applying the common electrical potential into the common electrode of the upper plate; and forming the seal pattern along edges of the lower substrate, the seal pattern having a detour adjacent to each of the conductive contact dot and being substantially a semi-circle with a first bent portion and a second bent portion in the conductive contact dot.

Hereinafter, embodiments of the present invention will be explained in more detail with referring to attached drawings.

Fig. 5 is a plan view illustrating a seal pattern according to an embodiment of the present invention.

As shown in Fig. 5, the seal pattern 200 is constructed with a substantially triangular shape in the embodiment of the present invention. That is, the seal pattern 200 is patterned in order to locate a vertex of the seal pattern with triangular shape toward the display area "A" so that the length of the seal pattern protruded into the display area "A" can be minimized.

Since the seal pattern with a triangular shape is formed as above and therefore, the bent portion decreases, it is possible to print the seal pattern with a dispenser-print method.

Each of the bent portion of the seal pattern in the present invention can be indicated by a first vertex "r1", a second vertex "r2", and a third vertex "r3", the bent portions "r1", "r2" and "r3" has a circular shape for preventing the cutting off the pattern by the dispenser-printing. The shape of the bent portions "r1", "r2", and "r3" will be explained in Fig. 6.

The sliver dot 10 with a length "d" extended from the bent portion "r2" is formed outside of the display area "A". Also, the linear distance between the first and the third vertexes can be defined as "*l*".

The distance between the first and third vertexes is 5 to 20 millimeters and the distance between the second vertex "r2" and the silver dot 10 is 0.1 to 2 millimeters in the preferred embodiment of the present invention.

Fig. 6 is a plan view expanded of the first vertex "r1". As shown in Fig. 6, the seal pattern is bent circularly adjacent to the first vertex "r1". The radius of the rotation of the bent circle can be defined as "R" as shown the figure, and preferably, the length of the radius of the rotation is 0.5 to 5 millimeters. The above description relates to the first vertex "r1",

however, it can be applied to the second and third vertexes "r2" and "r3". In other words, the second and third vertexes also bent circularly with a predetermined radius of the rotation.

The above description relates to the triangular shape seal pattern forming bent portions with the first, second, and third vertexes, however, the present invention is not limited to it.

Namely, as shown in Fig. 7, the seal pattern can be constructed without the second vertex. In other words, as shown in Fig. 7, the seal pattern 200 has first and second bent portions "r1" and "r2" as rounded vertexes around the silver dot 10 so that it can be formed with a circular or elliptical shape.

The circular or elliptical seal pattern shown in Fig. 7 also has a radius of the rotation of the bent portions "r1" and "r2", the radius of the rotation may be adjusted from 0.5 to 5 millimeters.

As mentioned above, the seal pattern shapes adjacent to the silver dot 10 is bent with triangular or circular shapes and thereby minimizing the bent portion so that the length of the seal pattern protruded into the display area "A" can decrease. Therefore, the present invention has an advantage of minimizing the display spots adjacent to the silver dot in the liquid crystal display device.

Further, since the number of bent portion and bent angle is less than the conventional seal pattern, the present invention has another advantage of obtaining superior print quality in forming seal patterns with the dispenser-print method.

[EFFECT OF THE INVENTION]

In case applying the seal pattern according to the present invention into the liquid crystal display device, the area protruded into the display area by the seal pattern around the silver dot is decreased so that the present invention has an advantage of decreasing the display spots around the silver dot.

Also, since the seal pattern is formed with the dispenser-print method, the present invention has another advantage of removing the pollution resulted from contact between the substrate and screen in case of screen-printing.

[RANGE OF CLAIMS]

[Claim 1]

A method of forming a seal pattern in a liquid crystal display device, wherein the device comprises an upper plate forming a common electrode, a lower substrate having a pad applying a common electrical potential in thereof and a liquid crystal interposed in the upper and lower substrates, wherein seal pattern prevents the liquid crystal interposed in the upper and lower substrates from leaking outside, the method comprising:

forming plural conductive contact dots on the pad applying the common electrical potential of the lower substrate, the conductive contact dots applying the common electrical potential into the common electrode of the upper plate; and

forming the seal pattern along edges of the lower substrate, the seal pattern having a bent shape adjacent to each of the conductive contact dot, the bent shape being bent inwardly toward the liquid crystal around the conductive contact dots and being substantially a triangular shape with a first, second and third bent portions.

[Claim 2]

The method according to claim 1, wherein the seal pattern in the conductive contact dot is extended to the third bent portion with a predetermined radius of rotation from the first bent portion via the second bent portion, wherein the third bent portion is extended with a predetermined radius of rotation.

[Claims 3]

The method according to claim 1 or 2, wherein the conductive contact dot comprises a sliver (Ag).

[Claim 4]

The method according to claim 2, wherein the radius of the rotation of the first, second, and third bent portions is 0.5 to 2 millimeters.

[Claim 5]

The method according to claim 2, wherein a linear distance between the first bent portion and the third bent portion is 5 to 20 millimeters.

[Claim 6]

The method according to claim 2, wherein a linear distance between the conductive contact dot and the second bent portion is 0.1 to 5 millimeters.

[Claim 7]

A method of forming a seal pattern in a liquid crystal display device, wherein the device comprises an upper plate forming a common electrode, a lower substrate having a pad applying a common electrical potential in thereof and a liquid crystal interposed in the upper

and lower substrates, wherein seal pattern prevents the liquid crystal interposed in the upper and lower substrates from leaking outside, the method comprising:

forming plural conductive contact dots on the pad applying the common electrical potential of the lower substrate, the conductive contact dots applying the common electrical potential into the common electrode of the upper plate; and

forming the seal pattern along edges of the lower substrate, the seal pattern having a detour adjacent to each of the conductive contact dot and being substantially a semi-circle with a first bent portion and a second bent portion in the conductive contact dot.

[Claim 8]

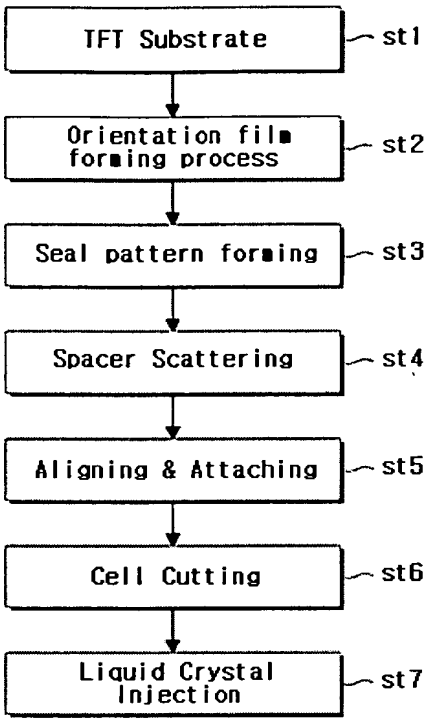
The method according to claim 8, wherein the seal pattern in the conductive contact dot is extended to the second bent portion with a predetermined radius of rotation from the first bent portion and the seal pattern between the first and second bent portions is concave toward the liquid crystal.

[Claim 9]

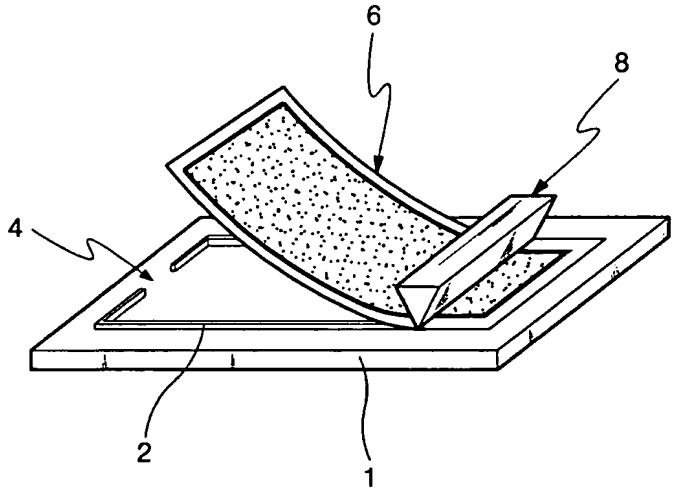
The method according to claim 8, wherein a linearly extended distance of the first and second bent portions is 5 to 20 millimeters.

[DRAWINGS]

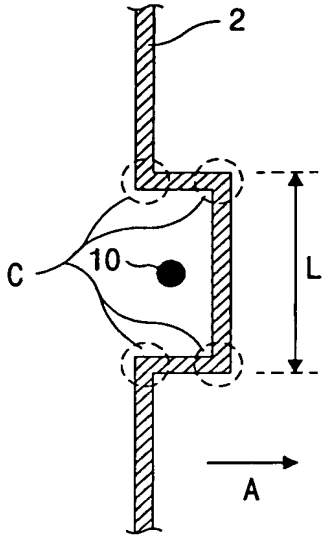
[Fig. 1]



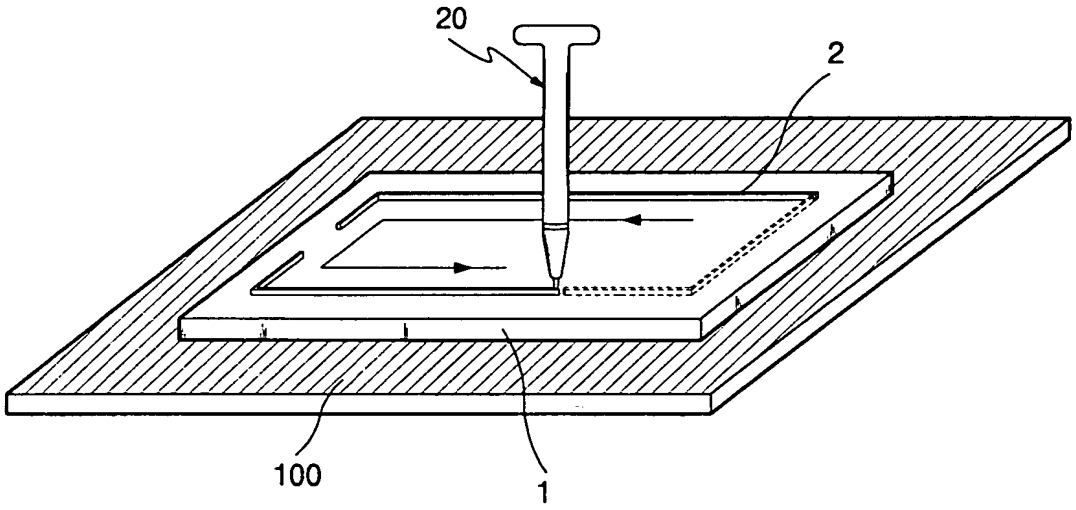
[Fig. 2]



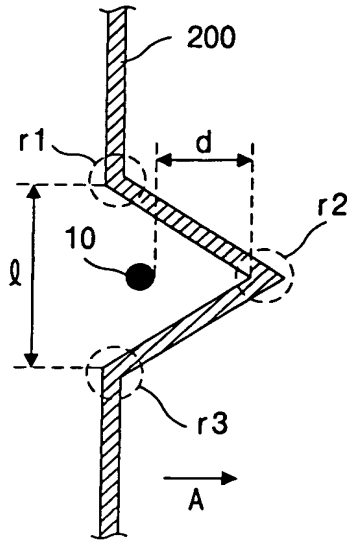
[Fig. 3]



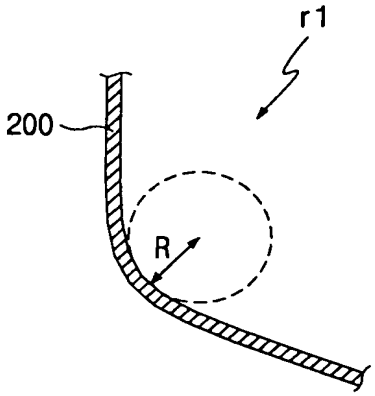
[Fig. 4]



[Fig. 5]



[Fig. 6]



[Fig. 7]